A Report Prepared for

Van Waters & Rogers Inc.
6100 Carillon Point
Kirkland, Washington 98033

EXHIBIT #3
WORK PLAN
BOISE TOWNE SQUARE MALL SUPPLEMENTAL INVESTIGATION AND FINAL REMEDIATION
BOISE, IDAHO

HLA Job No. 10987 404

by

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4.0 SCHEDULE

Table 1 presents the Schedule and Table 2 presents a Deliverables List. Implementation of the field work will begin contingent upon the effective date of the Consent Order. The draft Site Investigation Report and Risk Assessment Report presenting the work described in 3.0 will be submitted to the Department following work completion. This schedule is dependent on access to undertake the work, the results of the investigation and any data gaps that may be identified and addressed during completion of the investigation tasks outlined herein. The RAP will be initiated upon finalization of the Site Investigation Report and Risk Assessment Report.

TABLE OF CONTENTS

TABLE OF CONTENTS
(continued)

LIST OF TABLES

LIST OF ILLUSTRATIONS

1.0 INTRODUCTION

Harding Lawson Associates (HLA) has prepared this Work Plan for Van Waters & Rogers Inc. (VW&R), Kirkland, Washington, to describe a planned supplemental investigation, implementation of an interim remedial measure, and evaluation and implementation of additional source control or other activities for final remediation at the Boise Towne Square Mall, Boise, Idaho (Site) (Plate 1). VW&R is one of the parties negotiating with the State of Idaho Department of Health and Welfare, Division of Environmental Quality (Department) concerning terms of a Consent Order regarding the activities described in this Work Plan. VW&R and the other parties are referred to herein as Respondents and are defined in the Consent Order. The actual boundaries of the Site are defined in the Consent Order to which this Work Plan is an exhibit. This investigation will supplement the previous soil gas and soil boring investigations conducted by VW&R in 1991 (*HLA, 1991b and 1991c*) and investigations conducted by other parties (see Section 2.2).

From approximately 1973 to 1983, VW&R operated a small chemical distribution facility from a portion of a warehouse located on Friedly Drive, Boise, Idaho. A 6,000-gallon aboveground storage tank (AST) used to store perchloroethylene (Perc) was located in an outdoor storage area at the eastern end of the former warehouse. Nielsen Transfer & Storage Co. (NT&S) also occupied a portion of the warehouse throughout the term of the VW&R lease. The property was apparently owned by a number of parties during VW&R's tenancy, including NT&S, Nielsen Warehousing Company, Monteford Brooks, and Shirley O'Rielly (n/k/a Shirley O'Rielly Crowe). An underground petroleum storage tank (UST) was reported by Price Development Corporation to have been used at the warehouse site by NT&S and removed during mall construction. In

approximately 1987 or 1988, the warehouse was removed. Today, a Pier 1 Imports store occupies the general area where the warehouse partially occupied by VW&R was located (Nielson Warehouse). The current address of the Pier 1 Imports store is 140 Milwaukee Avenue, Boise, Idaho. The general location of the Pier 1 Imports store is referred to herein as the "140 Milwaukee Avenue Area". The Boise Towne Square Mall, mall parking lot, and other retail establishments which are associated with the mall occupy the area north, northeast, and west of the 140 Milwaukee Avenue Area (Plate 1).

The objectives of this effort are to:

- Perform interim source control activities (vapor extraction) for Perc Compounds in the vicinity of the former VW&R distribution facility;
- Evaluate existing Site wells and abandon those which may transport Perc Compounds and other contaminants from the surface to the subsurface or between Hydrostratigraphic Units;
- Assess the extent and migration pathway(s) of Perc Compounds and Aromatic Compounds at the Site in soil gas, soil, and groundwater and if other Source Locations are identified, and if warranted, characterize the contamination at those Source Locations;
- Characterize the geology and hydrogeology of the Site;
- Evaluate potential risks to human health and the environment at and immediately downgradient from the Site that may be posed by the presence at the Site of Perc Compounds and, if emanating from the area where the UST at the Nielsen Warehouse was located, Aromatic Compounds;
- Evaluate the need for, select, and implement remediation activities on the Site, as appropriate, which could include groundwater treatment, or expansion of soil vapor extraction for final remediation.

This Work Plan is structured as follows: Section 2.0 describes the background of the Site and the results of previous investigations in the Site vicinity. Section 3.0 describes the scope of work for the Site investigation. Sections 4.0 and 5.0 present the schedule and list of references, respectively. The procedures to be used for work

activities outlined in this Work Plan are described in the Quality Assurance Project Plan (QAPP) (*HLA, 1992*).

2.0 BACKGROUND

2.1 Site

The Site generally includes the 140 Milwaukee Avenue Area and the Boise Towne Square Mall property and is generally bordered by Milwaukee Street and the theater to the west, the mall perimeter road to the north and east, and the Union Pacific Railroad and Franklin Road to the south. The Site is more completely described in the Consent Order and is illustrated on Plate 1.

2.2 Previous Investigations

Beginning in approximately 1987, the Site and the area west and north of the Site were developed. Projects include the Boise Towne Square Mall, a portion of a Westpark Shopping Center Associates (Westpark) development, development by Walla Walla Shopping Center Associates, other retail stores, light commercial buildings, and high density housing. Since 1987, several environmental investigations have been performed in the Site vicinity. Data was collected at different times as part of the following investigations:

- Westpark Environmental Assessments conducted by Special Resource Management (SRM)
- Private Well Sampling downgradient of the Westpark site in July 1988 and April 1989 by SRM in cooperation with and at the request of the Department
- Westpark Remedial Action Plan written in January 1989 by SRM
- Quarterly groundwater monitoring by SRM pursuant to the January 13, 1989, Consent Order between the Department and Westpark
- Site assessment of Mervyn's (in the Boise Towne Square Mall) conducted in March 1989 by Dames & Moore
- Soil sampling upgradient of and at the Pier 1 site in April and July 1989 by the Department

- Site investigation conducted at the Baird Oil facility during the summer of 1990
- Sampling of surface water (from the South Slough) and groundwater from private wells downgradient of the Westpark site in October 1990 (groundwater and surface water), July 1991, and April 1992 (surface water only) by the Department
- Site assessment of the Pier 1 Imports store in June 1991 by Professional Service Industries, Inc. (PSI)
- Installation of four groundwater monitoring wells in the Boise Towne Square Mall vicinity in July 1991 by Chen-Northern for the Department
- Environmental site evaluation of the Boise Towne Square Mall conducted in August 1991 by GZA GeoEnvironmental, Inc. (GZA)
- Soil gas and groundwater investigation in the vicinity of Pier 1 Imports conducted during September 1991 by HLA
- Soil boring investigation near Pier 1 Imports conducted during November 1991 by HLA
- Site investigation conducted at the Sinclair Station, Franklin and Cole Roads, in January 1992
- Monitoring well sampling at the Boise Towne Square Mall conducted by Industrial Health Incorporated-Environmental (IHI) in June 1992.

A summary of each of the above investigations is presented in the following sections. Based on review and interpretation of available information, sampling, laboratory, and analytical methodologies used by various parties for Perc identification and quantification in these investigations differ. The data that follows should be used qualitatively. Plate 2 shows the locations of wells sampled during these investigations and Perc concentrations detected.

2.2.1 Westpark Investigations

During the development of the proposed Westpark Center (property bounded by Benjamin Lane, Milwaukee Street, and Emerald Street), Perc was detected in soil and groundwater samples. Subsequently, SRM was retained to conduct investigations of the

extent and source of the Perc contamination. The first assessment was completed in November 1987. Soil and groundwater samples were collected and analyzed. Results indicated that Perc was detected in a groundwater sample (*SRM, 1989*).

The second site assessment was completed in March 1988 (*SRM, 1988*) to characterize the extent of the Perc contamination on the Westpark property. Additional monitoring wells were installed and sampled and approximately 28 surface and near surface soil samples collected in the vicinity of Well MW-1. Results indicated that Perc was present in groundwater in a plume oriented northwest across the property at concentrations ranging from 10 to 2,500 ppb. Perc was also detected in three of the surface composite soil samples collected where Westpark Extraction Wells 1, 2, and 3 are currently located at concentrations ranging from 3 to 300 ppb. No samples were collected beyond the property boundaries by SRM.

The third site assessment was completed in October 1988 and included the collection and analysis of 20 shallow soil samples. Perc was detected at low concentrations in 7 of the shallow soil samples (*SRM, 1989*).

In January 1989, Westpark and the Department agreed to a Consent Order that incorporated the cleanup plan presented in SRM's Remedial Action Plan (RAP) (*SRM, 1989*). The RAP proposed to pump and treat groundwater via air stripping to a cleanup level of 10 µg/l (the EPA's current proposed maximum contaminant level [MCL] for Perc is 5 µg/l, although no MCL was proposed at the time the Consent Order was signed). Groundwater treatment began on March 12, 1990, and is currently underway. Treated groundwater is discharged to the South Slough irrigation collection/recharge system operated by the Nampa-Meridian Irrigation District. Groundwater monitoring is conducted and reported to the Department quarterly during treatment system operation.

2.2.2 Mervyn's Parcel

During February 1989, Dames & Moore conducted a site assessment on the Mervyn's parcel at the Boise Towne Square Mall. Five monitoring wells (1, 2U, 2L, 3U, and 3L) were installed (two sets of which were deep/shallow well pairs) and sampled (Plate 2). Laboratory analytical results of groundwater samples collected from the wells indicated that no volatile organic compounds (VOCs) were detected in any of the wells (*Dames & Moore, 1989*).

2.2.3 Baird Oil Facility

During the summer of 1990, James M. Montgomery (JMM) conducted site investigation and remediation activities at a former Phillips 66 service station on Franklin and Cole Roads, Boise, Idaho (*JMM, 1990*). The Station was demolished and five underground storage tanks removed in April 1990. Seven monitoring wells (MW-1 through MW-7) were installed and sampled. Additionally, soil samples were collected from test trenches to evaluate the extent of soil contamination. Laboratory analytical results indicated that benzene, toluene, and xylenes were present in groundwater collected downgradient (west to northwest) of the former tanks at concentrations exceeding state MCLs. Total petroleum hydrocarbons were present in soil samples at concentrations greater than 100 mg/kg northwest of the former tanks. JMM subsequently excavated approximately 5,000 cubic yards of contaminated soil. Confirmation soil samples indicated that remaining TPH concentrations were below 100 mg/kg. Groundwater in Well MW-7 and in the excavation was subsequently treated by aerating the hydrocarbons using a sprinkler system and holding ponds. Treated water was discharged to the storm drain which empties into the Ridenbaugh Canal. BTEX concentrations were reduced but remained above state MCLs in Well MW-7 in

September 1990. JMM recommended that the excavation be backfilled and Well MW-7 be sampled quarterly.

2.2.4 State of Idaho Surface Water and Groundwater Sampling

In October 1990, the Department initiated a sampling program for the collection and analysis of surface and groundwater samples from the area downgradient of the Westpark development. Thirty-four samples were collected from 10 surface water locations (South Slough and drains/seeps entering it), 19 shallow (less than 100 feet deep) or unknown depth domestic wells, and 5 deeper (greater than 100 feet deep) domestic or supply wells. Sampling was conducted by Department staff by directly filling sample containers with water from the slough or outside taps nearest the wells (*Baldwin, 1991*). In July 1991, the Department collected six surface water samples from the South Slough. In April 1992, the Department collected eight surface water samples from the South Slough.

Results of the October 1990 sampling event indicated that Perc was detected in the South Slough surface water beginning at approximately its intersection with Emerald Street, increasing as the slough flows northwest to Maple Grove Road and then decreasing throughout the remainder of the length sampled. Samples collected upstream of the air stripper effluent discharge point contained no detectable Perc. The highest Perc concentration (224 µg/l) was detected at a groundwater seep in the vicinity of Emerald Street. According to Department staff, the seep was most likely groundwater from the shallow aquifer discharging into the slough. The highest Perc concentration in the slough was 137 µg/l at the intersection with Ridenbaugh Canal.

Results of the July 1991 South Slough sampling event detected Perc in the slough at concentrations between 1 and 54 µg/l. Samples taken downstream of the intersection

of the slough with Maple Grove Road had Perc concentrations ranging from 3.3 to 4.2 µg/l indicating dilution with water diverted into the slough from the Ridenbaugh Canal. No groundwater seeps were sampled.

Results of the April 1992 South Slough sampling event detected Perc in the slough at concentrations ranging from 0.4 to 6.9 µg/l. The trends in Perc concentrations along the length of the slough observed during the 1991 and 1992 sampling events were similar to those observed in 1990.

Of 24 groundwater samples collected in October 1990, 15 contained detectable concentrations of Perc. Perc was detected in a majority of the shallow or unknown depth domestic groundwater wells at concentrations ranging from 1.27 to 147 µg/l (Plate 2). Perc was only detected in 2 of the deep wells; the Syringa well (134 µg/l; total depth of 200 feet) and one other domestic well (currently identified as D-1) near Syringa (17.3 µg/l; total depth of 300 feet).

2.2.5 State of Idaho Well Installation

To assess the groundwater quality in the vicinity of Pier 1, in July 1991, four groundwater monitoring wells were installed by Chen-Northern, Boise, Idaho, for the Department (Plate 2) (*Chen Northern, 1991*). The Department subsequently sampled the monitoring wells and submitted the samples for chemical analysis. Results indicated that Perc was present in the samples at concentrations ranging from nondetectable (ND) to 656 µg/l (*Conde, 1991*). The 656 µg/l may not represent the actual concentration due to laboratory dilution requirements. Samples collected by the Department in October 1991 from Wells MW-1 and MW-2 indicated that Perc was detected at a concentrations of 7,370 µg/l in MW-1 and was not detected in MW-2.

2.2.6 Pier 1 Environmental Assessment

An environmental site assessment was conducted in June 1991 at the Pier 1 Imports store by PSI. The site assessment consisted of reviewing available environmental information regarding the site vicinity and conducting an onsite reconnaissance. No soil or groundwater samples were collected during PSI's investigation. PSI concluded that the site where the Pier 1 Imports store is now located was suspected by the Department to be the point of origination of Perc contamination known to be present in the area. PSI recommended that a subsurface investigation be conducted at the site.

2.2.7 Boise Towne Square Mall

In June 1991, GZA completed an environmental site investigation for the O'Connor Group, New York, New York, to assess the presence of hazardous materials in soil and/or groundwater on the Mall Property. As part of this investigation, GZA installed and sampled six groundwater monitoring wells on the Mall Property (Plate 2). Analytical results (using a non-standard analytical method) of samples collected from the six wells, along with two of the Department's wells (Wells MW-1 and MW-2) sampled by GZA, indicated that Perc was detected in five of the eight samples at concentrations ranging from 56 to 2,500 parts per billion (*GZA, 1991*). The monitoring wells were not secured with locking covers.

2.2.8 140 Milwaukee Avenue Area Soil Gas and Groundwater Investigation

To evaluate the potential for the location where the former VW&R facility was located to be a source of Perc in soil and groundwater, to evaluate the potential for other sources of Perc in soil and groundwater, and to assess the horizontal extent of Perc in the immediate vicinity of the 140 Milwaukee Avenue Area, HLA conducted a soil gas and groundwater field investigation for VW&R between September 12 and 17, 1991 (*HLA, 1991b*). Activities included measuring water-levels from the four existing

Department monitoring wells (Wells MW-1 through MW-4), collecting and analyzing groundwater samples from Wells MW-1 and MW-2, and conducting a soil gas survey in the vicinity of 140 Milwaukee Avenue.

Results indicated that groundwater elevations in the four Department wells ranged from 2686.34 to 2687.01 feet mean sea level (MSL), and groundwater flowed toward the west/northwest at an approximate gradient of 0.001 to 0.003 ft/ft. Groundwater samples collected from Well MW-1 contained Perc, trichloroethene (TCE), and 1,2-Dichloroethene (DCE) (cis and trans) at concentrations of 5100, 70, and 63 µg/l, respectively. Groundwater from Well MW-2 contained Perc and 1,1,1-trichloroethane (TCA) at concentrations of 6.1 and 2.0 µg/l, respectively.

Results of the soil gas survey indicated that Perc was detected in 25 of 34 samples at concentrations ranging from 0.11 to 5,500 µg/l. TCE was detected in 18 samples at concentrations ranging from 0.02 to 1,800 µg/l. Cis-1,2 DCE was detected in 10 samples at concentrations ranging from 0.6 to 540 µg/l. Vinyl chloride and trans-1,2 DCE were detected in two samples at concentrations of 5.8 and 3.3, and 2.2 and 0.71 µg/l, respectively. Ethylbenzene was detected in 10 samples at concentrations ranging from 2 to 1,200 µg/l.

2.2.9 140 Milwaukee Avenue Area Property Soil Boring Investigation

To confirm the presence and concentration of chemical constituents detected during the soil gas survey (*HLA. 1991b*), evaluate the potential for other VOCs to be present in soil, and to provide data to assist in the design of a pilot vapor extraction system (VES), on October 22, 1991, HLA supervised the drilling of four soil borings in the 140 Milwaukee Avenue Area for VW&R. Two borings were drilled in the vicinity of the former Perc tank location, one was drilled at the southeast corner of the

140 Milwaukee Avenue building, and one was drilled approximately 220 feet downgradient (west-northwest) of the former tank location. The borings were drilled to approximately 1 foot below the water table at depths ranging from 13.5 to 14.5 feet and soil samples were collected for lithologic characterization and chemical analysis at approximately 2-foot intervals.

The data indicated that the highest concentrations of chemicals were detected in samples collected from Borings B-1 and B-2, drilled in the immediate vicinity of the former tank location.

Perc was detected in all soil samples at concentrations ranging from 0.014 to 26,000 milligrams per kilogram (mg/kg). TCE was detected in four samples collected from Borings B-1 and B-2 at concentrations ranging from 0.4 to 3.1 mg/kg. Methylene chloride was detected in all but two samples at concentrations ranging from 0.16 to 1.1 mg/kg. Carbon tetrachloride was detected at a concentration of 0.18 mg/kg in the sample collected from Boring B-1 at 9.5 feet. Cis-1,2 Dichloroethene was detected in three samples collected from Borings B-1 and B-2 at concentrations ranging from 0.014 to 1.3 mg/kg. The soil sample collected from Boring B-3 at 8 feet contained 1,1,1-TCA at a concentration of 0.016 mg/kg.

TPH were not detected in any of the samples. Moisture contents by weight ranged from 3.5 to 18 percent.

2.2.10 Sinclair Service Station

In January 1992 the Idaho State Insurance Fund notified the Franklin Oil Company that a fuel leak was suspected at the Sinclair Service Station, Franklin and Cole Roads, Boise, Idaho. Franklin Oil Company then installed 2 groundwater monitoring wells and 11 soil borings at their site. Laboratory analytical results indicated

that soil samples contained TPH at concentrations ranging from <10 to 14,500 mg/kg. The highest concentrations were in samples collected from the northern portion of that site. Groundwater analytical results indicated that benzene was detected at concentrations ranging from 1,210 to 5,200 ppb, toluene at concentrations ranging from 4,700 to 11,800 ppb, ethylbenzene ranging from 800 to 2,400 ppb, and xylenes from 5,400 to 19,000 ppb (*Chisom, 1992*).

2.2.11 Boise Towne Square Mall Monitoring Well Sampling

In June 1992, IHI, Salt Lake City, Utah, sampled six existing monitoring wells installed by GZA on the Boise Towne Square Mall Property. The sampling was performed on behalf of the Boise Towne Square Mall Development Company and Price Development Company. Analytical results of samples collected from the six GZA wells indicated that Perc was detected in three of the six samples at concentrations ranging from 400 to 2,500 ppb (*IHI, 1992*). TCE and cis-1,2 DCE were detected in the sample collected from GZA-4 at concentrations of 45 and 150 ppb, respectively.

2.3 Site Hydrogeology

The shallow geology in the Site vicinity consists of 50 to 150 feet of unconsolidated silt, sand, and gravel of Pleistocene Age, referred to as older terrace gravels, that have been reworked and deposited by the Boise River (*Dion, 1972*). These older terrace gravels comprise the shallow aquifers in the area.

Underlying the older terrace gravels and separated by an unconformity is the Glenns Ferry Formation. The Glenns Ferry Formation is Late Pliocene to Early Pleistocene Age and is composed of interbedded clay, silt, sand, fine gravel and basalt up to 2,000 feet thick (*Dion, 1972*).

A shallow aquifer in the site vicinity is present under water table conditions at an approximate depth of 8 to 15 feet below ground surface (bgs). Localized groundwater recharge and discharge vary seasonally. Recharge generally occurs from the Ridenbaugh Canal, Farmers Lateral located south of the mall, and local agriculture irrigation during the irrigation season between April and October. However, localized groundwater discharge to the slough has been observed in the area. Although the water table level and flow direction may fluctuate with the irrigation season, the predominant regional flow direction in this shallow aquifer is to the northwest. The presence of an aquitard separating the upper aquifer from the lower Glenns Ferry aquifer system is unconfirmed for the West Boise Area. Well logs for the area suggest that the aquitard is laterally discontinuous.

The deep aquifer system lies in the sand, gravel, and basalt of the Glenns Ferry Formation and has been reported as a confined aquifer (*Mink and LeBaron, 1976*). The deep aquifer is recharged primarily from infiltration of precipitation and snowfall along the foothills and ridge areas and potentially from the shallow aquifer. Discharge from the aquifer is primarily from the Boise Water Corporation for domestic and industrial use. Studies on the aquifer hydraulic characteristics indicate that the transmissivity is approximately 15,750 gallons per day per foot and has a coefficient of storage of 0.02 (*Mink and LeBaron, 1976*).

Both the shallow and deeper aquifers may be influenced by the current drought conditions and lack of precipitation induced recharge.

3.0 SCOPE OF WORK

3.1 Task 1. Interim Control Measures

The objective of Task 1 is to perform interim source control activities for Perc contaminated soil in the vicinity of the former VW&R distribution facility. Limited groundwater remediation will also occur, although the target media is soils. To meet this objective, VW&R has installed and will operate the pilot soil vapor extraction system (VES) as described in the *Work Plan, Pilot Soil Vapor Extraction System, Former VW&R Facility, Boise, Idaho*, dated January 24, 1992. The pilot system uses vapor recovery and activated carbon units and is designed to mitigate the migration of contamination and to accomplish expedited source control in soils that have been affected by VOCs. Application of the VES to contaminated soils will minimize the potential for future groundwater contamination resulting from leaching of chemicals from the soil by fluctuating groundwater levels or soil pore water in this area. Following VES installation and operation, the need for modification to or expansion of the system will be evaluated using the results of actual operational data. The pilot system is designed to enable expansion to accommodate removal of contaminants from additional areas identified as appropriate for vapor extraction source control, as further defined in the VES Work Plan (*VW&R, 1992*). The VES system will be operated under an air permit issued by the State of Idaho, Division of Environmental Quality. Copies of the permit application, permit, and VES Work Plan are included in the appendix. Proposed operation and monitoring activities are described in detail in the same appendix.

Additionally, if activities described in Task 2 (Section 3.2) indicate that existing wells on the Site potentially transport Perc Compounds from the surface to the subsurface or between Hydrostratigraphic Units, are improperly maintained or otherwise present an unacceptable risk, the wells will be abandoned by Respondents following

approval from the well owner(s), or as the owners are directed by the Department. Respondents will abandon the wells by either pulling or perforating the well casing and backfilling with a cement/bentonite grout or bentonite chips from the bottom of the well to within several inches of the ground surface. The grout will be pumped through a tremie pipe from the bottom of the wells to displace standing water. The uppermost portion of the former well will be filled with asphalt patch. All work will be performed in accordance with state and local regulations for well abandonment. A letter report describing Respondents' well abandonment will be provided to the Department.

3.2 Task 2. Evaluate Existing Wells

The objective of Task 2 is to evaluate existing Site wells and determine which wells should be abandoned due to questionable integrity. To evaluate existing Site wells including the quality of the existing groundwater data and the integrity of the wells for potential monitoring use, Respondents will inventory wells on the Site by conducting a visual survey of the property and appropriate interviews, and review applicable reports relating to the well installations. When available, boring logs and well completion diagrams will be obtained and reviewed. Respondents will attempt to secure access to the wells with all appropriate persons. Groundwater levels and total depths of the wells will be measured with a chalked steel tape or other suitable equipment.

3.3 Task 3. Assess Extent of Perc Compounds and Aromatic Compounds

The objective of Task 3 is to assess the extent of Perc Compounds and Aromatic Compounds in soil gas and to qualitatively evaluate the extent of Perc Compounds and Aromatic Compounds in soil and groundwater at the Site. This objective will be

achieved by using existing data and collecting new data to fill in data gaps that exist, and resolve questionable data.

Respondents intend to meet this objective by conducting a soil gas survey cross- and downgradient of the 140 Milwaukee Avenue Area. Results of the soil gas survey will also be used to effectively select groundwater monitoring locations and identify areas requiring additional soils investigation.

The field activities will be performed by an HLA geologist, hydrogeologist or field technician under the supervision of an Idaho registered geologist. Before field activities begin, the proposed work will be coordinated with appropriate Department, Mall, Pier 1, and other owner/operator personnel, as well as utility companies. Preliminary discussions with representatives of these organizations indicate access for the activities described below will be granted. Equipment decontamination, field work and waste material storage and disposal will be performed in accordance with procedures described in the QAPP (*HLA, 1992*). Site safety procedures will be as described in the existing Site Safety Plan (*HLA, 1991a*). The QAPP will be submitted for review and approval by the Department. The Site Safety Plan and addenda to the Site Safety Plan will be developed as necessary and submitted to the Department for review.

3.3.1 Soil Gas Investigation

To assess the extent of Perc Compounds and Aromatic Compounds in soil gas, HLA will supervise a soil gas survey at the Site. The primary objective of the soil gas survey is to qualitatively evaluate the extent of Perc Compounds and Aromatic Compounds in groundwater at the Site. As described in the Soil Gas and Groundwater Investigation report (*HLA, 1991b*), soil gas data can be used as a reconnaissance tool to evaluate the horizontal extent of groundwater contamination. In addition, soil gas

concentrations will be evaluated to identify any anomalous patterns to assist in identifying other Source Locations and soil contamination. The survey will be conducted by Hydro Geo Chem, Inc., Tucson, Arizona, under contract to Respondents, and under the supervision of HLA.

HLA proposes to collect soil gas samples from sampling points determined by using a grid system with approximately 100 foot by 100 foot spacing (Plate 3). Additional samples will be collected if data indicates potential Source Locations or further data is needed to qualitatively evaluate the extent of groundwater contamination. Sampling locations will be cleared for utilities using utility maps, a private electrical contractor, and by calling the Dig Line, Boise, Idaho. Actual sampling locations may vary depending on field conditions, the results of the utility clearance, and field data gathered during the course of this investigation.

Sample collection, analyses, and handling procedures will be in accordance with the QAPP (*HLA. 1992*); however, no separate Sampling and Analysis Plan will be prepared for this effort.

3.4 Task 4. Additional Soils Investigation

The objective of this task is to quantitatively evaluate the extent and migration pathways of Perc Compounds and Aromatic Compounds in soil for other source identification, selection and design of remedial measures, and interpretation of anomalous soil gas patterns. Additional soil borings will be drilled on the Site to meet these objectives. If chemical analyses identify other areas of soil contamination that may be sources of groundwater contamination, additional analytical procedures may be used for identification of potential sources. Specific procedures, rationale, and additional boring locations, if required, will be identified in a separate Supplemental Soil and Pilot

Boring Sampling and Analysis Plan. Drilling and sampling techniques will be as described in the Department-approved QAPP (*HLA, 1992*).

3.5 Task 5. Characterize Geology and Hydrogeology

The objective of Task 5 is to characterize the geology and hydrogeology of the Site. To meet this objective, HLA proposes to drill a pilot boring at the former Perc AST location, evaluate aquifer parameters, and, if conditions warrant, perform a seismic reflection survey. The decision whether to proceed with the reflection survey will be made in consultation with the Department. Depending on the results of this work, further investigation may be conducted as described below.

3.5.1 Pilot Boring

To assist in the characterization of geologic and hydrogeologic conditions at the Site, a pilot boring will be drilled near the former Perc AST location to evaluate the stratigraphic distribution of aquifer and aquitard units. Specific procedures, rationale, borehole logging methods, and additional boring locations, if required, will be identified in a separate Supplemental Soil and Pilot Boring Sampling and Analysis Plan. Soil samples will be collected as described in the QAPP (*HLA, 1992*).

Geophysical well logging will be used to assist in lithologic characterization and definition of stratigraphic units (aquifers or aquitards). A borehole geophysical investigation consists of a variety of methods which are incorporated into a geophysical logging system designed to survey the stratigraphic section intersected by the borehole. Because a single well log does not normally provide the total information desired, it is common practice to record three or more logs in a particular borehole. The following logs may be performed in the borehole: caliper, natural gamma, spontaneous potential, single point resistance, and 16-inch and 64-inch normal resistivity logs. Gamma

gamma, temperature, flowmeter and video logs may also be performed. All geophysical logs will be recorded in both analog and digital format. Procedures for field use of geophysical logging equipment are described in the QAPP (*HLA, 1992*).

Following geophysical logging, the pilot boring will be converted to a deep monitoring well using procedures described in the QAPP (*HLA, 1992*). Additional deep monitoring wells will be required on the Site if 1) the pilot boring indicates that deep groundwater contamination exists, 2) the geophysical investigations fail to successfully characterize Site geology and hydrogeology, 3) deep borings are needed to evaluate aquifer parameters, or 4) related investigations indicate the potential for deep contamination at locations other than the pilot boring. Additional deep monitoring well locations, if required, will be described in a Supplemental Well Sampling and Analysis Plan.

3.5.2 Evaluation of Aquifer Parameters

Aquifer hydraulic properties (transmissivity and hydraulic conductivity) will be evaluated through an aquifer testing program. The aquifer test program will consist of step-drawdown tests, 24-hour constant rate discharge tests, and measurement of water-level recovery subsequent to each test. Aquifer tests will be performed in select wells that will be identified in a Supplemental Monitoring Well Sampling and Analysis Plan. Aquifer tests will be performed in accordance with procedures described in the QAPP (*HLA, 1992*).

3.5.3 Geophysical Investigations

Depending on the hydrogeologic conditions encountered during the drilling of the pilot boring, a seismic reflection survey may be conducted to further characterize the geology and hydrology of the Site, including delineation of the extent of any aquicludes

or clay layers and to further investigate the subsurface stratigraphy. A separate Geophysical Sampling and Analysis Plan will be prepared for this effort, if needed. Seismic reflection profiling is especially well suited to the investigation of these features. The profiles present a nearly continuous cross section showing acoustic variations caused by lithologic changes and structural features. The data are acquired without invasive sampling, thereby eliminating the creation of possible contaminant flowpaths. Initially, a testing phase of data collection will be conducted to assess the feasibility of the seismic survey. The testing phase will consist of several linear surveys, each approximately 200 feet long.

Upon completion of a successful testing phase, a full-scale study will commence. The approximate locations of the seismic lines will be determined after reviewing existing data and site conditions. The survey sensors will be spaced at approximately 10-foot intervals, allowing not only for laterally continuous information, but also vertically continuous information starting at a depth of approximately 30 feet and extending to a depth of 400 or more feet. This level of resolution should allow for the identification and correlation of larger geologic features.

A direct current electrical resistivity survey may be conducted to determine the extent of the clay layer if the seismic reflection test is not successful. Vertical Electrical Soundings will be conducted using a Schlumberger array, which consists of four earth-contacting electrodes arranged in a collinear array.

Electrical resistivity methods measure subsurface variations of the induced electrical flow due to changes in the electrical potential between two electrodes. These variations are related to changes in rock or soil types. The electrical resistivity method is commonly used to map vertical changes in subsurface materials.

3.6 Task 6. Installation and Sampling of Additional Monitoring Wells

The objective of Task 6 is to further characterize the hydrogeology, extent and migration pathway(s) of Perc and Aromatic Compounds and to resolve groundwater data gaps.

3.6.1 Installation of Additional Monitoring Wells

Monitoring wells will be constructed in areas where additional groundwater chemistry and/or flow data are required for plume characterization or development of remedial measures. A separate Supplemental Monitoring Well Sampling and Analysis Plan will be developed which identifies the rationale for the selection of the number, type, design, location, and sampling parameters of additional monitoring wells.

3.6.2 Groundwater Monitoring

Water-level measurements will be collected from newly installed wells and selected existing monitoring wells in accordance with procedures described in the QAPP (*HLA, 1992*). The water-level data will be used to calculate the groundwater flow direction and gradient, and vertical head distribution.

To assess the extent of Perc and Aromatic Compounds in groundwater, HLA will collect groundwater samples from newly installed wells and selected existing monitoring wells on the Site. Groundwater and quality control samples will be collected and analyzed in accordance with procedures described in the QAPP (*HLA, 1992*).

3.6.3 Laboratory Analytical Program

As described in the QAPP (*HLA, 1992*), all soil and groundwater samples will be transported via overnight mail to Data Chem, Salt Lake City, Utah. The soil and groundwater samples will be analyzed for Perc Compounds using EPA Test Method 8010, Aromatic Compounds using EPA Test Method 8020, TPH using EPA Test

Method 8015 (modified), and other organic and inorganic test methods as appropriate. Selected soil samples will also be analyzed for moisture content and grain size.

3.7 Task 7. Site Investigation Report

Following completion of the Site investigation, a draft Site Investigation Report will be submitted to the Department. The report will include data compiled during the investigation, plates, and analytical results.

3.8 Task 8. Evaluate Potential Risks to Human Health and the Environment

The objective of Task 8 is to evaluate potential risks to human health and the environment at the Site and immediately downgradient of the Site that may be posed by conditions arising from the presence of Perc Compounds and Aromatic Compounds, if appropriate, at the Site. To meet this objective, the results of the Site investigation will be evaluated using Department-approved risk assessment methodologies. Prior to beginning this task, a Risk Assessment Work Plan containing the risk assessment concept and methodologies will be submitted to the Department for their review and approval.

A risk assessment (RA) will be conducted in coordination with the Department to assist in guiding future activities for the Site. As part of the evaluation, site-specific, health-based cleanup levels (CLs) will be developed for each detected Perc Compound of concern. Aromatic Compounds, if detected and applicable, will also be addressed. CLs will be developed using standard Department-approved U.S. Environmental Protection Agency (EPA) methodologies to identify concentrations in environmental media that are expected not to impact human health or the environment.

Exposure scenarios, human intake assumptions, and toxicity values to be used in the calculation of CLs will be consistent with applicable Department-approved EPA

guidance documents. This information will be reviewed with Department staff at the start of this task. Human intake assumptions (e.g., inhalation rates, soil contact rates, ingestion rates) will be used in conjunction with EPA toxicity criteria (i.e., reference doses and slope factors) to estimate CLs that are expected to be protective of human health. CLs will be developed for known or potentially carcinogenic Perc Compounds and Aromatic Compounds of concern by targeting risk ranges of 10^{-4}, 10^{-5} and 10^{-6}, per Department-approved EPA guidelines (*EPA, 1989a*; *1989b*; *1990*). For each of the noncarcinogenic Site Perc Compounds of concern, the CLs will be calculated to determine if the ratio of the calculated daily intake (dose) to the acceptable daily intake (reference dose [RfD]) approaches or exceeds unity (1.0).

The primary pathways of exposure (pathways expected to be of highest concern) used in the development of the CLs will be evaluated on the basis of the likelihood of occurrence, and will be prioritized based on the toxicity, fate, and transport of the Perc Compounds and Aromatic Compounds of concern to specific human receptor locations. The potential transport processes associated with the chemicals detected at the Site will be identified to assess the locations at which potential exposure could occur. CLs will be calculated for three exposure scenarios based on the primary exposure pathways identified during the evaluation (e.g., inhalation, ingestion, dermal contact).

As indicated above, CLs developed for each of the scenarios will be compared to available state and federal toxicity criteria. Based on this evaluation, a final list of CLs for soil and groundwater will be proposed. The methods used for the evaluation will be fully documented, and the results of the evaluation will be summarized in a Risk Assessment Report.

selected remedial measure(s), potential impacts on the environment and surrounding community, regulatory or permit requirements, conceptual description of potential future changes in remedial measures, and other information as needed.

3.10 Task 10. Remedial Action Implementation and Monitoring Plan

Within 45 days of Department approval of the RAP, Respondents shall submit a Remedial Action Implementation and Monitoring Plan (Implementation Plan). The Implementation Plan will include the following elements:

- A description of the design and operation of Department-approved remedial actions;
- A description of the responsibility and qualifications of key personnel involved with the implementation, operation, and monitoring of the remedial actions;
- General construction plans and specifications to implement the remedial actions;
- Equipment descriptions;
- Operation and maintenance procedures;
- Health and safety procedures for both construction and operation of remedial actions;
- A schedule for construction, start-up, monitoring, and operation of remedial actions;
- A description of the soil and groundwater sampling and analytical approach, procedures, and methods to be used to monitor the effectiveness of remediation during RAP implementation and after remediation is completed, and to determine when cleanup levels have been reached;
- Waste generation and handling procedures;
- Potential and procedures for modification of the remedial measures; and
- Statistical analytical methods and procedures for evaluating when there has been a statistically significant increase from CLs.

Following Department approval of the Implementation Plan, Respondents will implement the remedial actions described in the plan. The cleanup will continue until sample results show contamination levels below the cleanup levels approved by the Department or The Asymptotic Limit has been reached as defined by the Asymptotic Protocol and pursuant to the process outlined in the Consent Order. The Asymptotic Protocol will be submitted as a separate document to the Department for review in conjunction with previously discussed sampling and analysis plans.

Thereafter, the Site will be monitored for the time period and at a frequency specified in the Department-approved Implementation Plan. Should the levels of contamination increase above the approved cleanup levels or asymptotic limits within the approved monitoring time period, remedial actions set forth in the approved RAP, or other measures agreed upon by The Parties, will be reinstated following consultation with the Department.

Quarterly progress reports will be submitted to the Department. The reports will contain the following information:

- A description and estimate of the percentage of work completed;
- Summaries of all Final Results received in the period since the last progress report and any other information obtained in the period since the last progress report as described in the Consent Order;
- Summaries of all changes made in the investigation and remediation actions during the reporting period;
- Summaries of all significant contacts by Respondents with representatives of the local community, public interest groups, or state government during the reporting period;
- Summaries of all problems or potential problems encountered by Respondents in carrying out the Work Plan during the reporting period;
- Actions by or on behalf of the Respondents taken to rectify problems;

- Changes in Respondents' consultant and contractor personnel during reporting periods; and
- Copies of inspection reports and laboratory/monitoring data.

4.0 SCHEDULE

Table 1 presents the Proposed Schedule and Table 2 presents a Deliverables List. Implementation of the field work will begin contingent upon the effective date of the Consent Order. The draft Site Investigation Report and Risk Assessment Report presenting the work described in 3.0 will be submitted to the Department following work completion. This schedule is dependent on access to undertake the work, the results of the investigation and any data gaps that may be identified and addressed during completion of the investigation tasks outlined herein. The RAP will be initiated upon finalization of the Site Investigation Report and Risk Assessment Report.

5.0 REFERENCES

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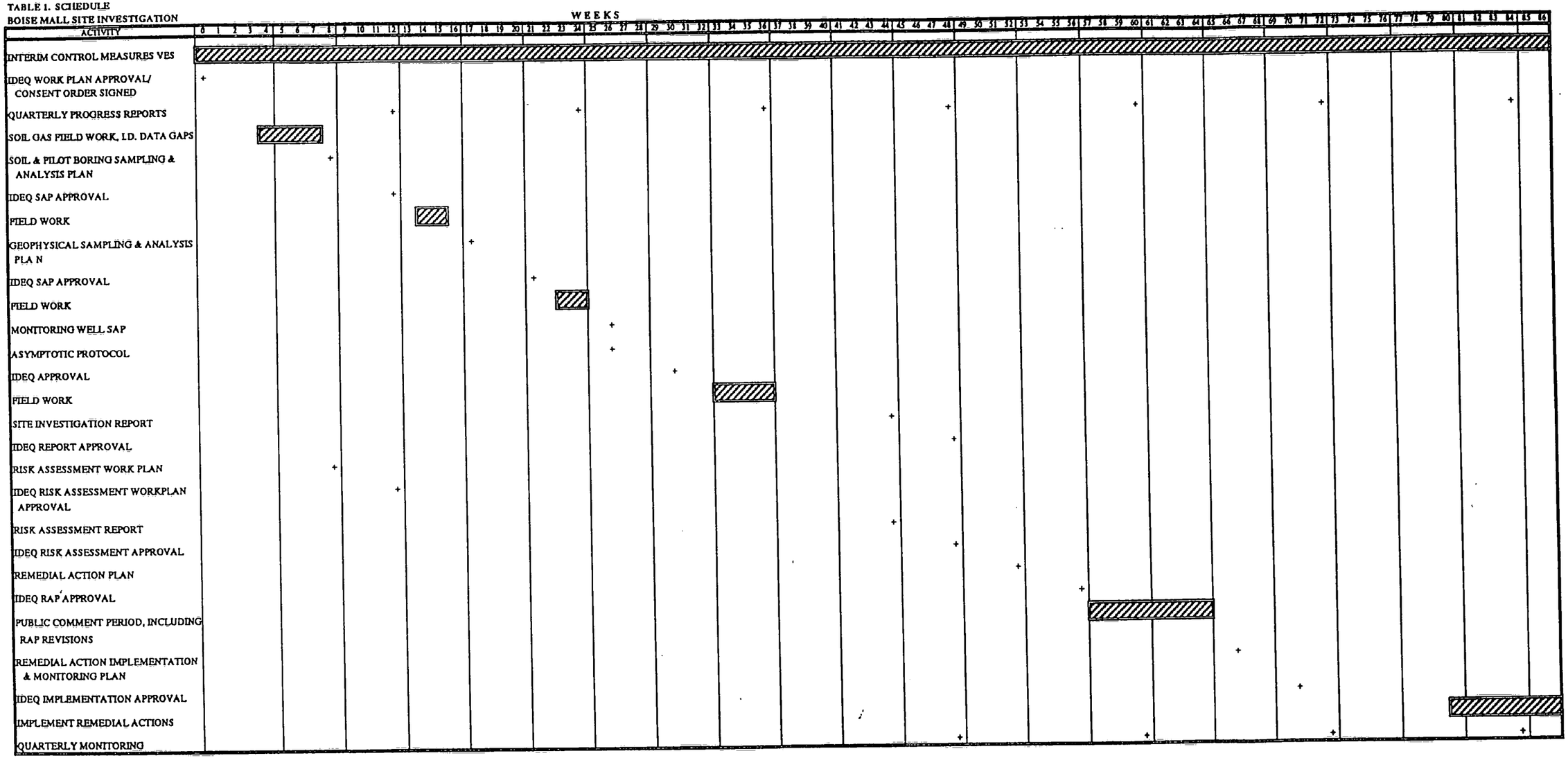
TABLES

Table 2. Deliverables List

Referenced Page Number	Deliverable
3, 17	QAPP
16	Well abandonment letter report
17	Site Safety Plan
19	Soil and Pilot Boring Sampling and Analysis Plan
20	Monitoring Well Sampling and Analysis Plan
21	Geophysical Sampling and Analysis Plan
23	Site Investigation Report
23	Risk Assessment Work Plan
24	Risk Assessment Report
25	Remedial Action Plan
26	Remedial Action Implementation and Monitoring Plan
27	Asymptotic Protocol

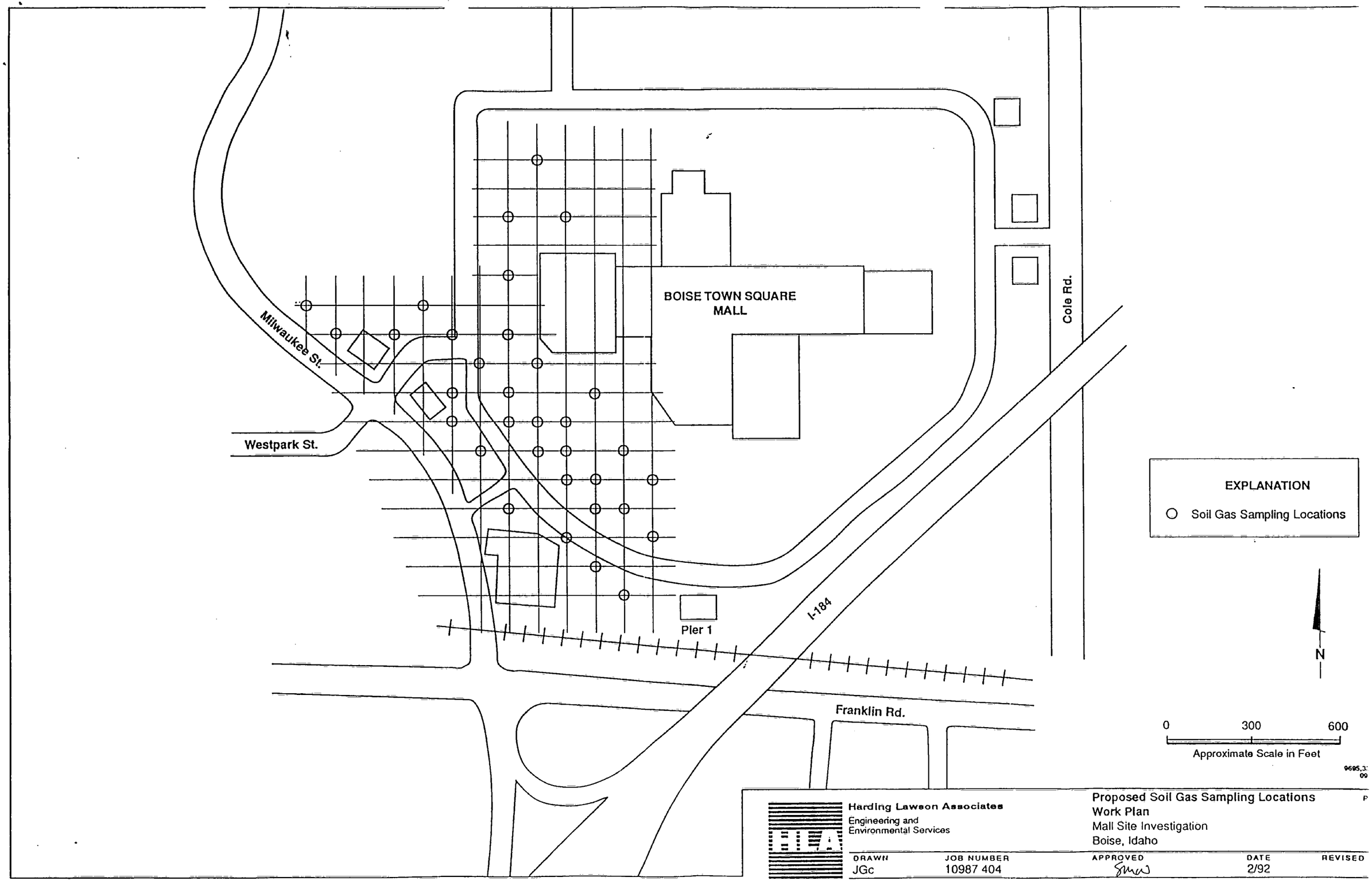
TABLE 1. SCHEDULE
BOISE MALL SITE INVESTIGATION



Notes: Assumed one 30-day IDEQ review and approval period for each deliverable.
+ Due date is defined as Friday of the week which is noted.

September 8, 1992 MALL SITE INV

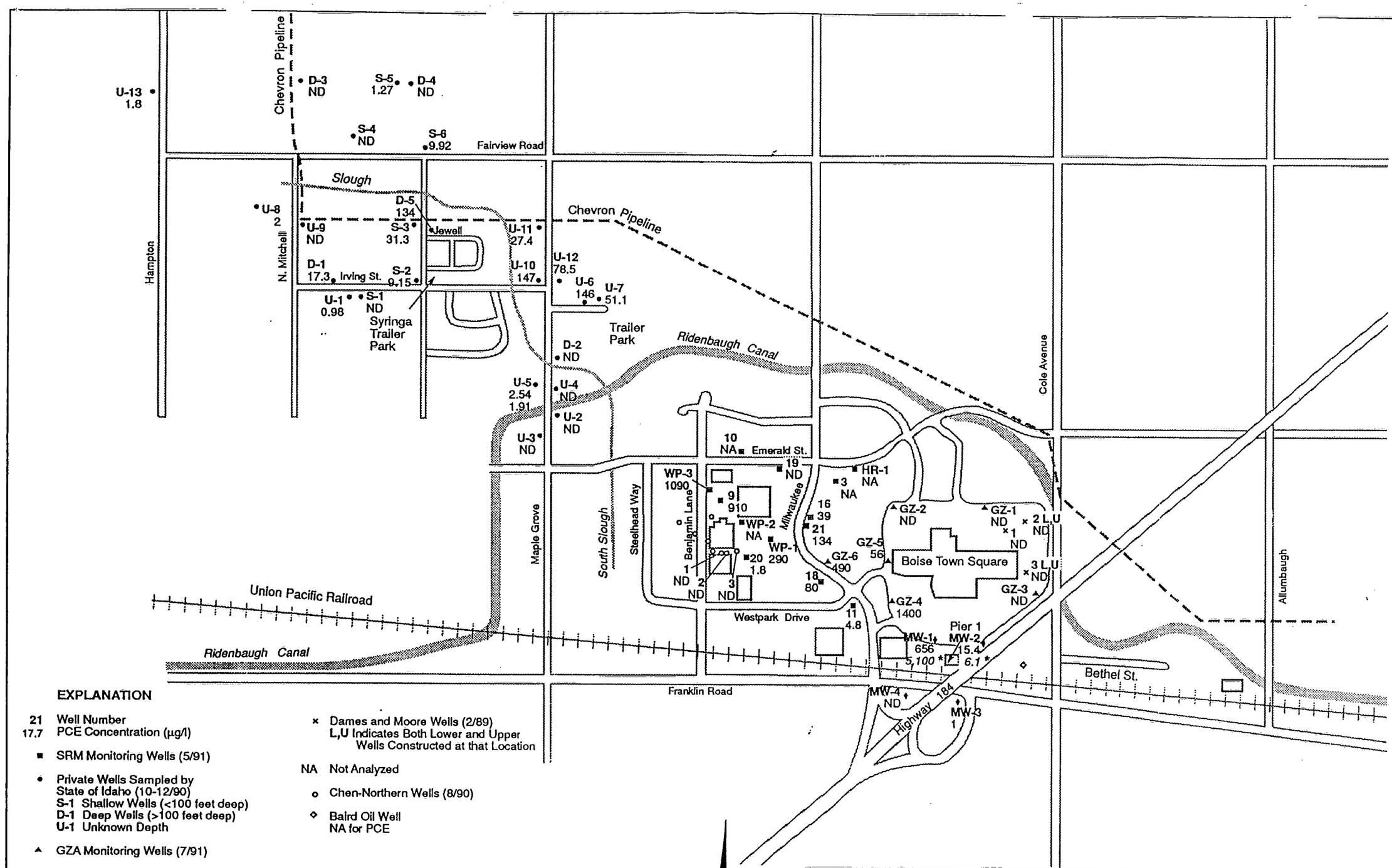
ILLUSTRATIONS



Harding Lawson Associates
Engineering and Environmental Services

Proposed Soil Gas Sampling Locations
Work Plan
Mall Site Investigation
Boise, Idaho

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED
JGc	10987 404		2/92	



EXPLANATION

- 21 Well Number
- 17.7 PCE Concentration (µg/l)
- ■ SRM Monitoring Wells (5/91)
- • Private Wells Sampled by State of Idaho (10-12/90)
  - S-1 Shallow Wells (<100 feet deep)
  - D-1 Deep Wells (>100 feet deep)
  - U-1 Unknown Depth
- ▲ GZA Monitoring Wells (7/91)
- ♦ State of Idaho Wells Sampled by Chen-Northern (7/91)
- * Sampled by HLA (9/91)
- × Dames and Moore Wells (2/89) L,U Indicates Both Lower and Upper Wells Constructed at that Location
- NA Not Analyzed
- o Chen-Northern Wells (8/90)
- ◇ Baird Oil Well NA for PCE

NOTE:
Sampling, laboratory and analytical methodologies used by various parties for PCE analysis differ; data should be used qualitatively.

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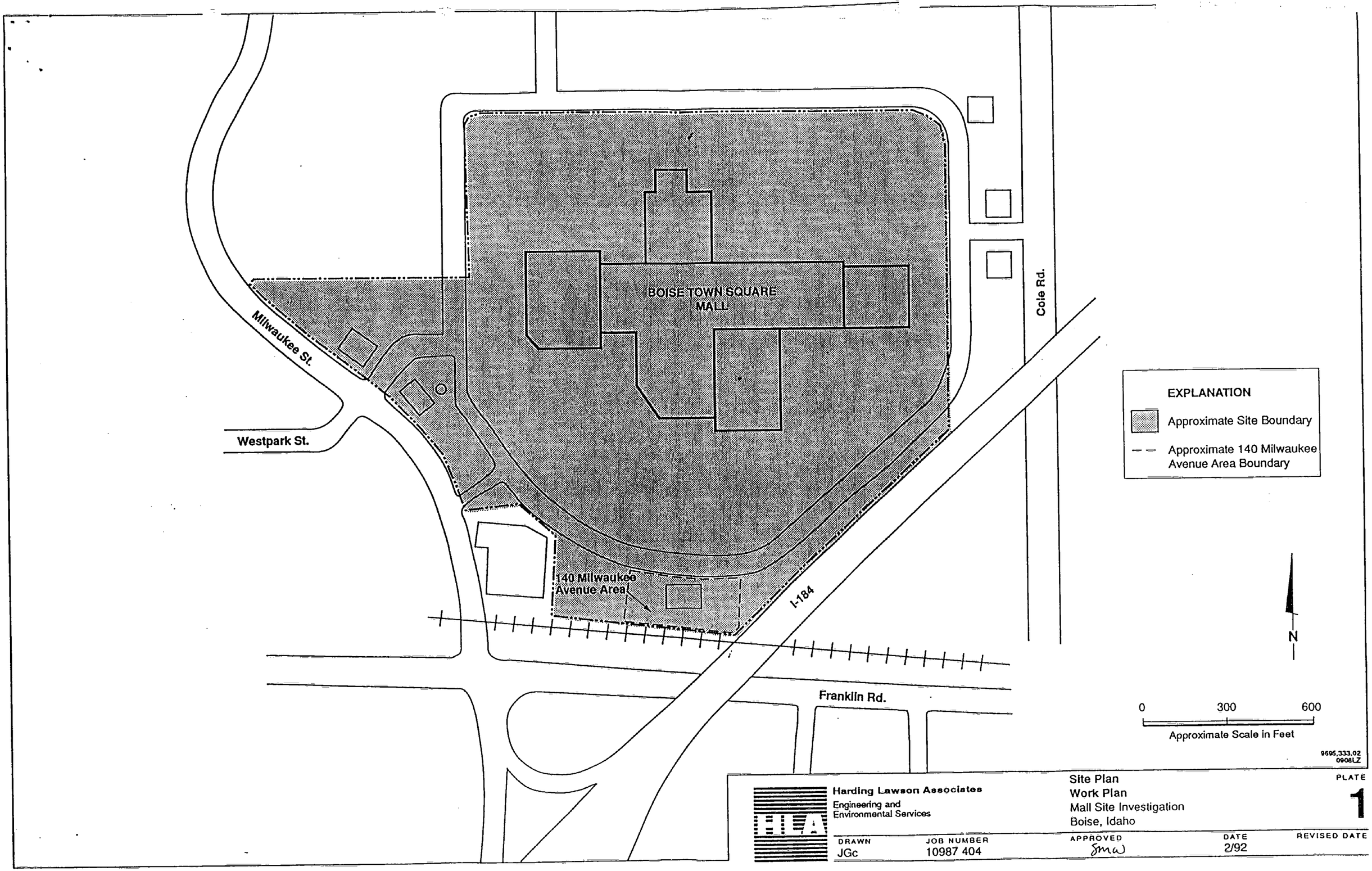
Harding Lawson Associates
Engineering and Environmental Services

Previous Investigation Well Locations
Work Plan
Mall Site Investigation
Boise, Idaho

PLA

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DA
JGc	10987 404		2/92	



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Harding Lawson Associates
Engineering and Environmental Services

Site Plan
Work Plan
Mall Site Investigation
Boise, Idaho

PLATE 1

DRAWN	JOB NUMBER	APPROVED	DATE	REVISED DATE
JGc	10987 404		2/92	